

# Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

RI-19-CT-01

*A Final Report to*

The New Hampshire Department of Environmental Services

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## Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

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### Executive Summary

The water quality of Spofford Lake is threatened by low concentrations of dissolved oxygen in the hypolimnion (bottom 10-15 meters), recent excessive plant growth in shallow littoral areas of the lake, and elevated levels of chloride. The primary concern for Spofford Lake is development in the watershed and the current and future contribution of nonpoint source pollution, such as phosphorus and chloride, in stormwater runoff from the steep grades in the watershed and from the mid to high-density development along the shoreline. The Spofford Lake Watershed Management Plan (WMP) identified stormwater runoff from existing development as the highest nutrient load source to the lake (at 50%). The WMP set an ultimate goal to reduce pollutant loading to Spofford Lake by 42 lbs/yr (27 lbs/yr from existing development and 15 lbs/yr from anticipated new development in the next 10 years) to improve in-lake median total phosphorus concentration by 5%.

To reduce nutrient loading to Spofford Lake, the project funded the conceptual design and implementation of stormwater controls on private and municipal properties in the Spofford Lake watershed. The project involved stakeholders and/or cash and in-kind funding sources from NHDOT, NHDES, Spofford Lake Association, engineers/consultants, municipal officials/staff from Chesterfield, and landowners. The project was anticipated to involve 11 sites and reduce nutrient loading to the lake by 29 lbs/yr of phosphorus, meeting 70% of the 42 lbs/yr reduction target set by Objective 2 in the WMP. The final project outcome involved 10 sites and reduced nutrient loading to the lake by 9.2 lbs/yr of phosphorus, meeting 22% of the 42 lbs/yr reduction target set by Objective 2 in the WMP.

Overall, the project was highly successful in achieving the anticipated pollutant load reductions given the fewer and smaller projects installed. A portion of the nutrient load from stormwater runoff to Spofford Lake was alleviated because of the improvements completed under this project. Some challenges with this project were landowner commitment and communication. One property owner backed out of the project after evaluations were complete and even though the property owner had already installed several of the recommended improvements. The property owner was wary of signing the agreements despite clear communication with them about expectations. One other property nearly backed out of the project because the primary contact experienced health issues. In the future, a back up contact should be identified for each project site. The town also noted one lesson learned with the North Shore Beach installations: have all parties (in this case, the town, construction crew, and engineers) meet on site during and immediately after installations are complete to review the proper installation and functioning of the BMPs. If this had been done for the North Shore Beach, the remaining erosion issue would have been identified sooner.

## Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

### Introduction

Spofford Lake (HUC010801070503) in Chesterfield, NH is a Class A waterbody that is highly valued for its aquatic habitat and recreational usage. However, the water quality of Spofford Lake is threatened by low concentrations of dissolved oxygen in the hypolimnion (bottom 10-15 meters), recent excessive plant growth in shallow littoral areas of the lake, and elevated levels of chloride. While most low oxygen impairments in lakes are attributed to elevated levels of nutrients, Spofford Lake has in-lake phosphorus concentrations well below oligotrophic criteria; thus, other factors, such as legacy or current organic matter loading (from historic logging or farming or current shoreline erosion) generating high sediment oxygen demand, may be causing the low oxygen levels. However, a primary concern for Spofford Lake is development in the watershed and the current and future contribution of nonpoint source pollution, such as phosphorus and chloride, in stormwater runoff from the steep grades in the watershed and from the mid to high-density development along the shoreline. Any pollutants that do make their way to the lake have a longer retention time as the lake only flushes every 5 years – increasing the chance for harmful blooms or excessive plant growth. Low oxygen in bottom waters of Spofford Lake is already causing a significant release of phosphorus from bottom sediment (a.k.a., internal phosphorus loading) as evidenced by the large difference between bottom and surface phosphorus concentration at 14 ppb. For these reasons, phosphorus was the focus of the water quality goal for the Spofford Lake Watershed Management Plan (WMP). The WMP set a goal to reduce pollutant loading to Spofford Lake by 42 lbs/yr (27 lbs/yr from existing development and 15 lbs/yr from anticipated new development in the next 10 years) to improve in-lake median total phosphorus concentration by 5%. The WMP identified treating stormwater runoff from existing development as one of the primary methods of achieving the WMP goal (the modeling estimated that 50% of the nutrient load source to the lake was coming from watershed stormwater runoff and baseflow). Areas of high concern for nutrient-laden stormwater runoff were the sub-basins of the Camp Spofford Inlet, direct shoreline area, and Silverdale Inlet. The 2017 watershed survey identified 16 sediment erosion sites that need remediation. The 2017 shoreline survey identified 10 high priority properties and 184 medium priority properties where stormwater management could be improved for water quality protection.

The project was completed from July 10, 2019 through December 31, 2021. The project evaluated and implemented stormwater controls on private and municipal land, including 4 of the 16 watershed survey sites and 6 of the 194 high/medium priority shoreline survey sites (note that there is some overlap between watershed and shoreline survey sites, but watershed survey sites took precedence in the site count). Two of the 4 watershed survey sites included the two town beaches – Wares Grove Beach and North Shore Beach – which were previously assessed and remediated prior to the official start of this project; however, pollutant load reduction estimates were still determined for these beach sites. Technical consultants assessed each site with landowner permission and developed conceptual designs (Technical Assistance Reports) that included a list of materials, estimated costs, and resources for implementing the recommended stormwater controls. Landowners used the designs to install the stormwater controls on their properties, adhering to the cost-share agreements and operation and maintenance agreements signed between the landowners and technical consultants. All necessary town and state permits were obtained prior to implementation. Technical consultants provided guidance to landowners during the installation process, assessed the final installations for proper functioning, and prepared NPS Site Reports and Pollutants Controlled Reports for each project site to document the implementation process and pollutant reduction estimates. By targeting stormwater runoff, the project reduced the amount of nonpoint source pollution in the form of sediment, nutrient, and heavy metal loading to the lake. The final project outcome reduced nutrient loading to the lake by 9.2 lbs/yr of phosphorus, meeting 22% of the 42 lbs/yr reduction target set by Objective 2 in the WMP. See project summaries in Tables 1 and 2 and a site map in Figure 1.

Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

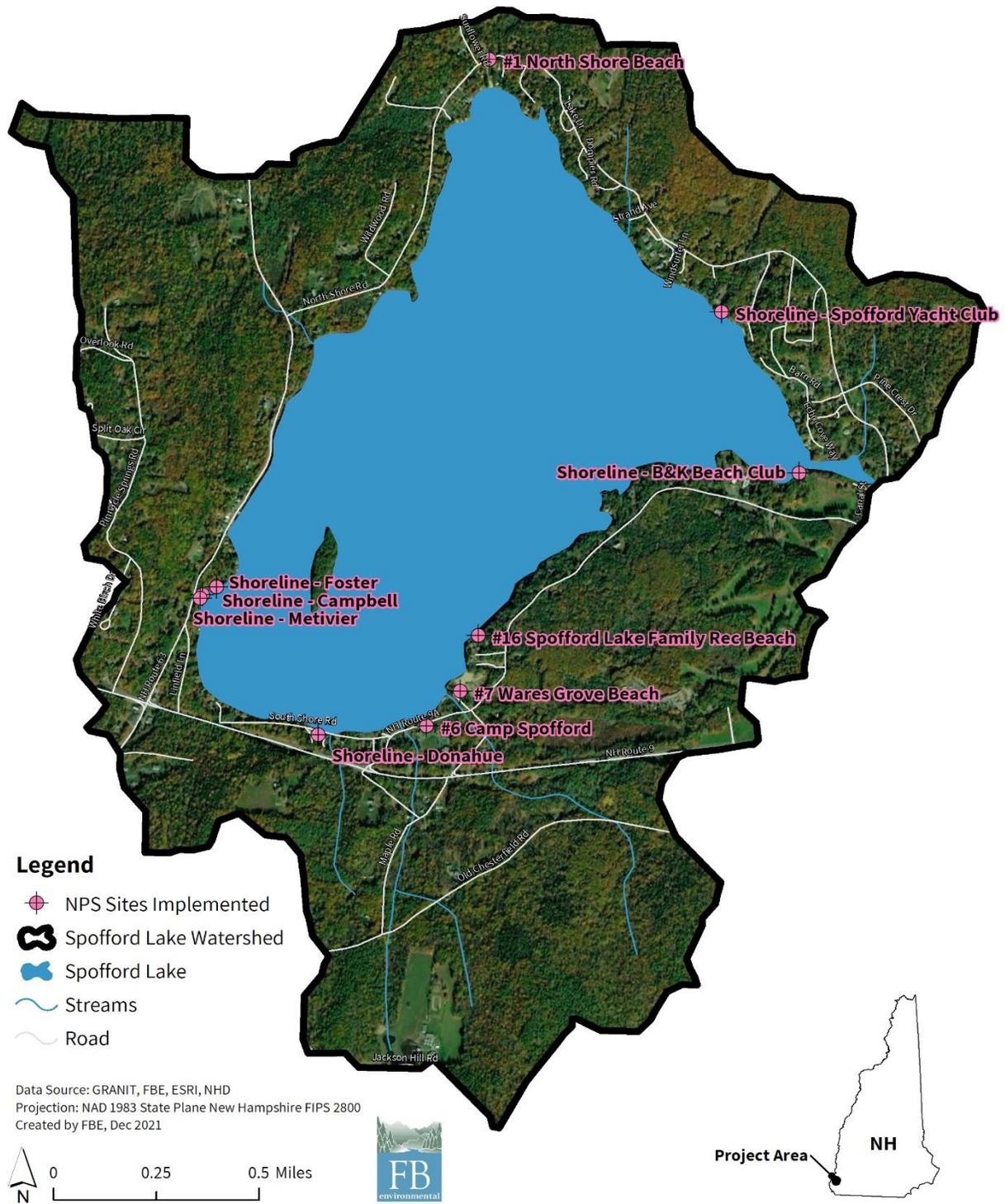


Figure 1. Map depicting the watershed of Spofford Lake in Chesterfield, NH and the NPS sites implemented as

**Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs**

part of this project.

## Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

**Table 1.** Summary of original grant allocation and actual spent by task for the project. Actual spent includes total in-kind and cash match.

Task	Task Description	Original Allocation			Actual Spent			
		Grant - Grantee	Grant - Consultant	Grant - Construction	Grant - Grantee	Grant - Consultant	Grant - Construction	Match
1	Develop and issue request for qualifications (RFQ). Provide the draft RFQ to NHDES for review and approval prior to publication.	\$191.00	\$0.00	\$0.00	\$191.00	\$0.00	\$0.00	\$0.00
2	Review responses to RFQ and select highest qualifications ranked consulting firm.	\$1,147.00	\$0.00	\$0.00	\$1,147.00	\$0.00	\$0.00	\$257.60
3	Draft subcontract and send to NHDES for review and approval.	\$191.00	\$0.00	\$0.00	\$191.00	\$0.00	\$0.00	\$0.00
4	Execute subcontract with consulting firm.	\$127.00	\$0.00	\$0.00	\$127.00	\$0.00	\$0.00	\$0.00
5	Hold a project kick-off meeting with stakeholders and steering committee.	\$382.00	\$0.00	\$0.00	\$382.00	\$0.00	\$0.00	\$231.84
6	Hold additional project meetings to facilitate task execution.	\$1,147.00	\$0.00	\$0.00	\$1,147.00	\$0.00	\$0.00	\$0.00
7	Submit electronic semi-annual reports documenting all work performed during the project periods, including pollutants controlled reports within one month of BMP implementation.	\$3,199.00	\$0.00	\$0.00	\$3,199.00	\$0.00	\$0.00	\$0.00
8	Submit Payment Requests to NHDES.	\$307.00	\$0.00	\$0.00	\$307.00	\$0.00	\$0.00	\$0.00
9	Submit a comprehensive final report to NHDES on or before the project completion date.	\$0.00	\$2,000.00	\$0.00	\$0.00	\$2,000.00	\$0.00	\$0.00
10	Execute project and contract management and coordination.	\$362.00	\$0.00	\$0.00	\$362.00	\$0.00	\$0.00	\$0.00
11	Complete draft SSPP; submit to NHDES for review.	\$255.00	\$696.00	\$0.00	\$255.00	\$696.00	\$0.00	\$0.00
12	Complete final SSPP incorporating responses to any NHDES comments and submit the final version to NHDES for signatures.	\$127.00	\$348.00	\$0.00	\$127.00	\$348.00	\$0.00	\$0.00
13	Conduct technical site visits.	\$127.00	\$3,220.00	\$0.00	\$127.00	\$3,220.00	\$0.00	\$512.50
14	Complete draft conceptual BMP designs including specific materials and costs required to implement the BMP.	\$127.00	\$14,078.00	\$0.00	\$127.00	\$14,078.00	\$0.00	\$1,167.54
15	Review and approve draft conceptual BMP designs; provide the designs to the landowners and NHDES for review and approval.	\$127.00	\$0.00	\$0.00	\$127.00	\$0.00	\$0.00	\$2,485.92

### Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

Task	Task Description	Original Allocation			Actual Spent			
		Grant - Grantee	Grant - Consultant	Grant - Construction	Grant - Grantee	Grant - Consultant	Grant - Construction	Match
16	Incorporate review comments to prepare the final conceptual BMP designs; distribute the finalized designs to the landowners and NHDES for final approval.	\$127.00	\$2,262.00	\$0.00	\$127.00	\$2,262.00	\$0.00	\$0.00
17	Draft and submit permit applications to appropriate agencies.	\$255.00	\$2,384.00	\$0.00	\$255.00	\$2,384.00	\$0.00	\$451.04
18	Draft and sign cost-share agreements with landowners.	\$191.00	\$1,044.00	\$0.00	\$191.00	\$1,044.00	\$0.00	\$25.52
19	Draft O&M plans in coordination with landowners and NHDES. Submit final version of O&M to landowners for signature and provide final O&M to NHDES.	\$255.00	\$1,044.00	\$0.00	\$255.00	\$1,044.00	\$0.00	\$25.52
20	Complete site walk with the landowner and volunteers to review conceptual BMP designs.	\$255.00	\$1,175.00	\$0.00	\$255.00	\$1,175.00	\$0.00	\$108.46
21	Track the Town of Chesterfield's work in completing construction of BMPs at Wares Grove and North Shore beaches.	\$382.00	\$174.00	\$0.00	\$382.00	\$174.00	\$0.00	\$0.00
22	Construct BMPs - Camp Spofford.	\$192.00	\$440.00	\$5,907.00	\$192.00	\$440.00	\$2,492.80	\$679.93
23	Construct BMPs - Lake Spofford Family Recreation.	\$127.00	\$267.00	\$4,907.00	\$127.00	\$267.00	\$4,718.27	\$4,415.52
24	Construct BMPs - Spofford Yacht Club.	\$127.00	\$266.00	\$3,908.00	\$127.00	\$266.00	\$3,862.32	\$2,194.72
25	Construct BMPs - B&K Beach Club.	\$127.00	\$266.00	\$2,908.00	\$127.00	\$266.00	\$4,116.81	\$1,488.52
26	Construct BMPs - Shoreline Sites (5).	\$508.00	\$811.00	\$11,538.00	\$508.00	\$811.00	\$7,064.74	\$37,391.33
27	Prepare NPS Site Reports detailing the process and outcome of the BMP construction and PCRs for each site.	\$179.00	\$5,357.00	\$0.00	\$179.00	\$5,357.00	\$0.00	\$0.00
28	Hold two watershed and nonpoint source pollution related outreach presentations for watershed residents.	\$1,911.00	\$0.00	\$0.00	\$1,911.00	\$0.00	\$0.00	\$0.00
29	Hold workshop on stormwater management at residential properties.	\$2,048.00	\$0.00	\$0.00	\$2,048.00	\$0.00	\$0.00	\$663.00
30	Coordinate with the Spofford Lake Association to track and document other eligible outreach and community activities related to watershed plan implementation, including activities such as SLA informational meetings, and Volunteer Lake Assessment Program related work.	\$500.00	\$0.00	\$0.00	\$500.00	\$0.00	\$0.00	\$63,625.72
<b>Total</b>		<b>\$15,000.00</b>	<b>\$35,832.00</b>	<b>\$29,168.00</b>	<b>\$15,000.00</b>	<b>\$35,832.00</b>	<b>\$22,254.94</b>	<b>\$115,724.68</b>

## Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

**Table 2.** Summary of BMPs implemented, including site identification information, NPS problem, BMPs installed, pollutant load reduction estimates, grant cost, match (in-kind and cash), and before/after photos.

<b>Task</b>	24	<b>Before: 5/15/20</b>		<b>After: 9/22/21</b>	
<b>Site #s</b>	Shoreline				
<b>Lot #</b>	05H-A007-001				
<b>Landowner Name</b>	Spofford Yacht Club				
<b>Address</b>	370 North Shore Rd, Chesterfield, NH				
<b>NPS Problem</b>	The gravel driveway and parking area to the main building at the Yacht Club is sloped down toward the water and can easily transport stormwater runoff. Shoreline erosion and lack of buffer in some areas and at the boat ramp is allowing runoff to the lake.				
<b>BMP(s) Implemented</b>	Rubber razor across the driveway diverts stormwater runoff to a sediment forebay and rain garden. Additional plantings were added to the existing planted terraced area next to the steps leading down to the beach and picnic area. A vegetated buffer and mulched pathway were added along the shoreline with secured timbers to stabilize the planting bed. A small rain garden was installed at the boat ramp.				
<b>TSS (tons/yr)</b>	0.0277				
<b>TP (lbs/yr)</b>	0.2				
<b>TN (lbs/yr)</b>	2.1				
<b>Grant</b>	\$3,862.32				
<b>Match - In-Kind</b>	\$2,194.72				
<b>Match -Cash</b>	\$0.00				
<b>Total</b>	\$6,057.04				

Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

Before: 5/15/20



After: 9/22/21



Before: 5/15/20



After: 9/22/21



Before: 5/15/20



After: 9/22/21



Caption: Before (left) and after (right) BMP implementation at the site.

**Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs**

<b>Task</b>	25
<b>Site #s</b>	Shoreline
<b>Lot #</b>	05K-B007-000
<b>Landowner Name</b>	B&K Beach Club
<b>Address</b>	B&K Drive, Chesterfield, NH
<b>NPS Problem</b>	The existing retaining wall between the grassed area and the beach is damaged and in need of repair. Repairing the retaining wall will help to capture runoff from the parking lot and grassed area from reaching the beach, which may otherwise generate significant scouring of sand into the lake.
<b>BMP(s) Implemented</b>	Repaired the existing retaining wall to prevent stormwater runoff and groundwater seepage from moving through damaged areas of the wall and onto the beach where it may scour the sand into the lake.
<b>TSS (tons/yr)</b>	0.03615
<b>TP (lbs/yr)</b>	0.3
<b>TN (lbs/yr)</b>	1.5
<b>Grant</b>	\$4,116.81
<b>Match - In-Kind</b>	\$1,488.52
<b>Match -Cash</b>	\$0.00
<b>Total</b>	\$5,605.33



Caption: Before (left) and after (right) BMP implementation at the site.

## Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

**Table 2 (continued).** Summary of BMPs implemented, including site identification information, NPS problem, BMPs installed, pollutant load reduction estimates, grant cost, match (in-kind and cash), and before/after photos.

<b>Task</b>	26	<p><b>Area 2 Before (8/12/20)</b></p> 		
<b>Site #s</b>	Shoreline			
<b>Lot #</b>	05A-A003-000			
<b>Landowner Name</b>	Campbell			
<b>Address</b>	1A Silverdale Rd, Chesterfield, NH			
<b>NPS Problem</b>	This property faces significant drainage issues coming from NH Route 63. The project recommended small-scale fixes to help stabilize erosion and slow runoff on the property, but the larger issue stemming from Route 63 will need to be addressed by the NHDOT.			
<b>BMP(s) Implemented</b>	Planted hardy shrubs near the shoreline to enhance the buffer. Large stone was added to the back of the property's wooded area adjacent to NH Route 63, as well as a black plastic corrugated pipe backfilled with crushed stone along the hillslope in two tiers.			<p><b>Area 2 After (8/27/21)</b></p>  
<b>TSS (tons/yr)</b>	0.1435			
<b>TP (lbs/yr)</b>	0.4			
<b>TN (lbs/yr)</b>	1.7			
<b>Grant</b>	\$2,361.23			
<b>Match - In-Kind</b>	\$1,760.88			
<b>Match -Cash</b>	\$0.00			
<b>Total</b>	\$4,122.11			

**Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs**

**Table 2 (continued).** Summary of BMPs implemented, including site identification information, NPS problem, BMPs installed, pollutant load reduction estimates, grant cost, match (in-kind and cash), and before/after photos.

Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

**Area 3: Before (8/12/20)**



**Area 3: After (8/27/21)**



**Area 3: After (8/27/21)**



**Area 3: After (8/27/21)**



Caption: Before (left) and after (right) BMP implementation at the site.

**Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs**

**Table 2 (continued).** Summary of BMPs implemented, including site identification information, NPS problem, BMPs installed, pollutant load reduction estimates, grant cost, match (in-kind and cash), and before/after photos.

<b>Task</b>	26			
<b>Site #s</b>	Shoreline			
<b>Lot #</b>	05A-A004-000			
<b>Landowner Name</b>	Metivier			
<b>Address</b>	818 NH Route 63, Chesterfield, NH			
<b>NPS Problem</b>	This property is steeply sloped down to the lake and experiences drainage issues coming from NH Route 63.	<b>Before: 5/16/2020</b>	<b>After: 9/10/2021</b>	<b>After: 9/10/2021</b>
<b>BMP(s) Implemented</b>	Added a vegetated rock garden to stabilize the hillslope leading down to the lake along the existing staircase on the south side of the property. Installed a dripline infiltration trench along the north side of the house that connects with an infiltration pathway with large paver stones serving as steps.			
<b>TSS (tons/yr)</b>	0.03755	<b>Before: 5/16/2020</b>	<b>After: 9/10/2021</b>	<b>After: 9/10/2021</b>
<b>TP (lbs/yr)</b>	0.2			
<b>TN (lbs/yr)</b>	0.9			
<b>Grant</b>	\$2,480.81			
<b>Match - In-Kind</b>	\$1,709.84			
<b>Match -Cash</b>	\$0.00			
<b>Total</b>	\$4,190.65			

Caption: Before (left) and after (right) BMP implementation at the site.

**Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs**

**Table 2 (continued).** Summary of BMPs implemented, including site identification information, NPS problem, BMPs installed, pollutant load reduction estimates, grant cost, match (in-kind and cash), and before/after photos.

<b>Task</b>	22			
<b>Site #s</b>	#6			
<b>Lot #</b>	05M-A014-000, 05M-A013-000, 05N-A001-000, 05N-A002-000, 05N-A004-000			
<b>Landowner Name</b>	Camp Spofford			
<b>Address</b>	24 Route 9A, Chesterfield, NH			
<b>NPS Problem</b>	Stormwater runoff issues were noted along the easternmost driveway and shoulder leading to a culvert that crosses under Route 9A towards the lake, as well as between Route 9A and the beach area. A stream that runs through the property had poor buffer in several areas, including a heavily trafficked area by the playground and cabins. Runoff was also coming off Route 9 to the uppermost parking lot near the stream.	<b>Before: 5/15/20</b>		<b>After: 6/12/21</b>
<b>BMP(s) Implemented</b>	Shrubs and plants were added to the easternmost driveway wood line and road shoulder area. An infiltration trench was installed along the wooden fence between the beach and Route 9A. Timbers and shrubs were added along the stream to stabilize the streambank and decrease foot traffic to the area. Timber curbing was added to the upper parking area off Route 9 to direct runoff away from the steep edge that leads down to the stream	<b>Before: 5/15/20</b>		<b>After: 6/12/21</b>
		<b>Before: 5/15/20</b>		<b>After: 5/29/21</b>



Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

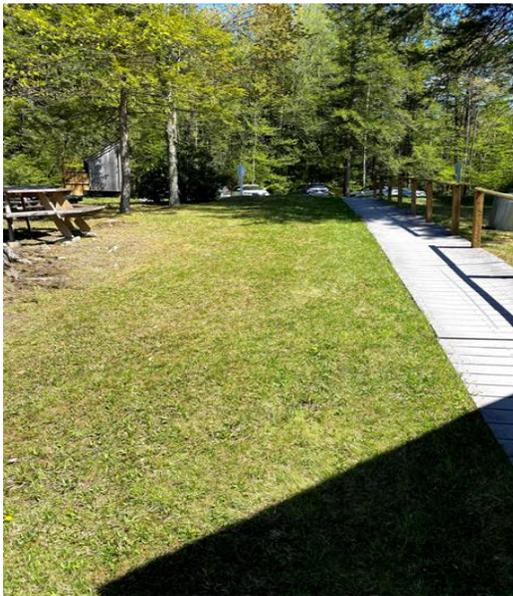
	and toward the existing catch basin.
<b>TSS (tons/yr)</b>	0.117
<b>TP (lbs/yr)</b>	0.4
<b>TN (lbs/yr)</b>	3.3
<b>Grant</b>	\$2,492.80
<b>Match - In-Kind</b>	\$679.93
<b>Match -Cash</b>	\$0.00
<b>Total</b>	\$3,172.73



Caption: Before (left) and after (right) BMP implementation at the site.

**Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs**

**Table 2 (continued).** Summary of BMPs implemented, including site identification information, NPS problem, BMPs installed, pollutant load reduction estimates, grant cost, match (in-kind and cash), and before/after photos.

<b>Task</b>	23	<p align="center"><b>Before: 5/16/20</b></p> 		<p align="center"><b>After: 10/9/21</b></p> 	
<b>Site #s</b>	#16				
<b>Lot #</b>	05M-A004-000	<p align="center"><b>Before: 8/20/18</b></p> 		<p align="center"><b>After: 10/9/21</b></p> 	
<b>Landowner Name</b>	Lake Spofford Family Recreation				
<b>Address</b>	105 NH Route 9A, Chesterfield, NH	<p><b>NPS Problem</b></p> <p>Runoff from the parking lot concentrates down the grassed slope adjacent to the walkway that leads from the parking lot to the beach. The picnic area is sandy with exposed tree roots. A flow path through the shrubbed shoreline area creates large gullies on the sandy beach.</p>			
<b>BMP(s) Implemented</b>	Installed a series of gently sloping grassed swales reinforced with surface stabilizers and infiltration trenches to help reduce the volume of runoff reaching and eroding the sandy beach. The picnic area was converted to a grassed area. Additional shrubs were added along the shoreline to better stabilize the shoreline area.				
<b>TSS (tons/yr)</b>	0.083				
<b>TP (lbs/yr)</b>	0.5				
<b>TN (lbs/yr)</b>	2.8				
<b>Grant</b>	\$4,718.27				
<b>Match - In-Kind</b>	\$4,415.52				
<b>Match -Cash</b>	\$0.00				
<b>Total</b>	\$9,133.79				

Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

Before: 5/16/20



After: 10/2/21



After: 10/2/21



Caption: Before (left) and after (right) BMP implementation at the site.

**Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs**

**Table 2 (continued).** Summary of BMPs implemented, including site identification information, NPS problem, BMPs installed, pollutant load reduction estimates, grant cost, match (in-kind and cash), and before/after photos.

<b>Task</b>	26			
<b>Site #s</b>	Shoreline	<b>Before: 5/16/20</b>		
<b>Lot #</b>	05B-B024-000		<b>After: 9/19/21</b>	
<b>Landowner Name</b>	Foster			
<b>Address</b>	4 Silverdale Rd, Chesterfield, NH			
<b>NPS Problem</b>	Stormwater concentrates down the neighbor's driveway and often flows toward and under the Fosters' house. The heavily used lake front area contains a sandy play area and a sandy ramped access point to Spofford Lake and contains minimal buffer.	<b>Before: 5/16/20</b>		
<b>BMP(s) Implemented</b>	A wetland practice was constructed in the back corner of the house to capture stormwater from the driveway towards the house before reaching the lake. The sandy beach access area was replaced with grass sod. A contained sandbox was constructed away from the lake. Additional plantings were added along the shoreline to stabilize the bank.			
<b>TSS (tons/yr)</b>	0.155	Caption: Before (left) and after (right) BMP implementation at the site.		
<b>TP (lbs/yr)</b>	0.7			
<b>TN (lbs/yr)</b>	3.8			
<b>Grant</b>	\$2,222.70			
<b>Match - In-Kind</b>	\$2,264.31			
<b>Match -Cash</b>	\$0.00			
<b>Total</b>	\$4,487.01			

**Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs**

**Table 2 (continued).** Summary of BMPs implemented, including a site identification information, NPS problem, BMPs installed, pollutant load reduction estimates, grant cost, match (in-kind and cash), and before/after photos.

<b>Task</b>	21	<div style="text-align: center;"> <p><b>Before: 6/20/17</b></p>  <p><b>During: 5/22/19</b></p>  </div>
<b>Site #s</b>	#1	
<b>Lot #</b>	05D-B034-000	
<b>Landowner Name</b>	Town of Chesterfield	
<b>Address</b>	North Shore Drive, Chesterfield, NH	
<b>NPS Problem</b>	The existing town-owned beach is unsuitably located due to the underlying ledge and poor soil overlay. The road drainage from North Shore Drive diverts to the entrance of the steeply graded parking lot, scouring the gravel parking lot and sandy beach. Large, deep gully formations are evident.	
<b>BMP(s) Implemented</b>	Two detention basins, underground piping, filtration system, regrading, two retaining walls, coir logs, plantings	
<b>TSS (tons/yr)</b>	0.3721	
<b>TP (lbs/yr)</b>	0.9	
<b>TN (lbs/yr)</b>	2.8	
<b>Grant</b>	NA	
<b>Match - In-Kind</b>	NA	
<b>Match -Cash</b>	NA	
<b>Total</b>	NA	

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		<p style="text-align: center;">After: 12/12/21</p>  <p style="text-align: center;">Caption: Before (left) and after (right) BMP implementation at the site.</p>
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**Table 2 (continued).** Summary of BMPs implemented, including a site identification information, NPS problem, BMPs installed, pollutant load reduction estimates, grant cost, match (in-kind and cash), and before/after photos.

<b>Task</b>	21	<p style="text-align: center;">Before: 6/20/17</p> 
<b>Site #s</b>	#7	
<b>Lot #</b>	05M-A011-000	
<b>Landowner Name</b>	Town of Chesterfield	
<b>Address</b>	Route 9A, Chesterfield, NH	
<b>NPS Problem</b>	<p>The town-owned beach is unsuitably located due to the underlying ledge and poor soil overlay. Sheet flow runoff from both Route 9 and 9A collect along the entire road length of the property. Five distinct runoff gully points are evident along the parking lot leading to the beach. Adjacent property drainage alterations are also overloading a brook defining the property boundary. The brook overflows onto the beach, causing more erosion. Sediment build-up in the</p>	

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	lake near the beach is evident.	<p style="text-align: center;">After: 12/12/21</p> 	
<b>BMP(s) Implemented</b>	Underground piping to rock-lined swale to detention basin with catch basin, which overflows through culvert to curtain apron leading to brook and lake. Plantings added.		
<b>TSS (tons/yr)</b>	1.6568		
<b>TP (lbs/yr)</b>	4.4		
<b>TN (lbs/yr)</b>	13.5		
<b>Grant</b>	NA		
<b>Match - In-Kind</b>	NA		
<b>Match -Cash</b>	NA		
<b>Total</b>	NA		

Caption: Before (left) and after (right) BMP implementation at the site.

## Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs

### Project Objectives

The goal of the Spofford Lake WMP is to improve the water quality of Spofford Lake. The project implemented Objective 2 of the Spofford Lake WMP by reducing the total phosphorus load to the lake. Specific actions items in the plan that the project implemented fall under Watershed & Shorefront BMPs which include addressing NPS issues identified during surveys and/or improving shoreline buffers along waterfront properties.

Objectives and associated deliverables specific to the project are provided in Table 3, along with an evaluation of how well each objective was achieved. Achieving the objectives for this project helped control NPS pollution from reaching Spofford Lake by reducing the total phosphorus load to the lake through the implementation of BMPs (see Project Outcomes & Measurable Results).

**Table 3.** List of objectives and associated deliverables for the project, as well as an evaluation of how well each objective was achieved.

Objective #	Objective Description	Objective Deliverable	Success Evaluation
<b><u>Objective 1:</u></b>	Complete project management and administration for grant execution.	Executed contract between consulting firm and SWRPC; project meeting minutes; semi-annual progress reports, pollutants controlled reports (PCR), and a final report submitted to NHDES.	After review of the responses to the RFQ, SWRPC selected FB Environmental Associates as the technical consultant to carry out the project. The subcontract agreement was signed on November 21, 2019. SWRPC submitted to NHDES timely meeting minutes, semi-annual progress reports (4), pollutants controlled reports, and a final report in December 2021.
<b><u>Objective 2:</u></b>	Develop a Site Specific Project Plan (SSPP).	Draft and final SSPP approved by NHDES.	A final approved SSPP was signed by all parties on March 26, 2020.
<b><u>Objective 3:</u></b>	Develop draft and final Technical Assistance (TA) Reports for BMP implementation at project sites.	Copies of the approved conceptual BMP designs and material cost estimates sent to NHDES and landowners.	Site visits to nine properties were completed on 5/15-5/16/20. Technical Assistance Reports detailing the conceptual designs and cost estimates were drafted and finalized by October 2020 for the nine properties based on review and feedback from the property owners, consultants, and NHDES.
<b><u>Objective 4:</u></b>	Meet procedural requirements and secure the legal authority to implement the proposed activities.	Copies of all necessary permits, cost-share agreements, and O&M plans submitted to the Town of Chesterfield, NHDES, and landowners.	Permits were filed with the state. CSAs and O&Ms were signed by the participating properties and submitted to NHDES.
<b><u>Objective 5:</u></b>	Improve the quality of Spofford Lake through	NPS Site Reports and Pollutants Controlled Reports	The eight participating properties completed one or more BMP

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	implementation of stormwater controls.	submitted to NHDES for each BMP site.	installations based on the approved designs. NPS Site Reports and Pollutants Controlled Reports were completed for each of the eight sites, plus the two beach sites, from October-December 2021 and submitted to NHDES.
<b>Objective 6:</b>	Provide public outreach and education on water quality protection.	Summary materials of outreach events submitted to NHDES.	A self-assessment survey was created to encourage thought provoking ways for homeowners to make changes to land use and improvements to reduce stormwater from entering the lake unfiltered.

**Project Outcomes & Measurable Results**

The ultimate environmental outcome set forth in the Spofford Lake WMP is achieving a 5% reduction in in-lake phosphorus concentration by reducing or offsetting both current and anticipated future phosphorus loading of 27 and 15 lbs/yr by 2028, respectively, for a total of 42 lbs/yr. The project was anticipated to involve 11 sites and reduce nutrient loading to the lake by 29 lbs/yr of phosphorus, meeting 70% of the 42 lbs/yr reduction target set by Objective 2 in the WMP. The final project outcome involved 10 sites and reduced nutrient loading to the lake by 9.2 lbs/yr of phosphorus, meeting 22% of the 42 lbs/yr reduction target set by Objective 2 in the WMP.

The outcome of the project was measured as pollutant load reduction estimates using the NHDES Simple Method, following steps described in the SSPP, which included taking before and after measurements of the BMP installation sites. Measurements included the dimensions of the BMP itself and the treatment drainage area. Percent reduction efficiencies were selected from the literature that matched closely to the installed BMP. Refer to Table 2 for a description of the BMPs installed and a summary of the pollutant load reduction estimates for each project site. Refer to Figure 1 for a map of site locations.

Overall, the project was highly successful in meeting the anticipated pollutant load reductions given the fewer and smaller projects installed. A portion of the nutrient load from stormwater runoff to Spofford Lake was alleviated because of the improvements completed under this project.

Analysis of water quality data as a measure of success would not be appropriate since the BMPs were installed in summer or fall 2021, leaving little opportunity for adequate “after” sampling of the lake or streams water quality. Anecdotally, the property owners noted noticeable reductions in stormwater runoff from their properties because of the BMPs installed. Additional monitoring years would be needed to determine success through water quality data.

The outreach for this phase of the project initially included events for landowners, lake users, Chesterfield residents, and the general public to attend. Due to the Covid-19 pandemic, changes needed to be made to keep the public safe while still delivering the intended message of maintaining a healthy lake and making improvements where possible. This was done by creating a self-assessment survey with links to specific do-it-yourself projects identified in the NH DES Homeowners Guide to Stormwater Management. The survey was provided to the Spofford Lake Association for review and input. An outreach plan for widespread distribution will be included in phase II.

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### Conclusions and Recommendations

The ultimate environmental outcome set forth in the Spofford Lake WMP is achieving a 5% reduction in in-lake phosphorus concentration by reducing or offsetting both current and anticipated future phosphorus loading of 27 and 15 lbs/yr by 2028, respectively, for a total of 42 lbs/yr. The project was anticipated to involve 11 sites and reduce nutrient loading to the lake by 29 lbs/yr of phosphorus, meeting 70% of the 42 lbs/yr reduction target set by Objective 2 in the WMP. The final project outcome involved 10 sites and reduced nutrient loading to the lake by 9.2 lbs/yr of phosphorus, meeting 22% of the 42 lbs/yr reduction target set by Objective 2 in the WMP.

Overall, the project was highly successful in meeting the anticipated pollutant load reductions given the fewer and smaller projects installed. A portion of the nutrient load from stormwater runoff to Spofford Lake was alleviated because of the improvements completed under this project.

There were some challenges with this project with delayed project start date, as well as landowner commitment and communication. The project start date was delayed one year from its original planned start date due to delays with state level funding approvals. One property owner backed out of the project after evaluations were complete and even though the property owner had already installed several of the recommended improvements. The property owner was wary of signing the agreements despite clear communication with them about expectations. One other property nearly backed out of the project because the primary contact experienced health issues. In the future, a backup contact should be identified for each project site to avoid unnecessary delays in communication and project installation work. The town also noted one lesson learned with the North Shore Beach installations: have all parties (in this case, the town, construction crew, and engineers) meet on site during and immediately after installations are complete to review the proper installation and functioning of the BMPs. If this had been done for the North Shore Beach, the remaining erosion issue would have been identified sooner.

Achieving the ultimate desired environmental outcome will require multiple phases of implementation efforts, including both structural and non-structural BMPs. The first phase (this project) implemented stormwater controls (that treat and infiltrate both the quality and quantity of stormwater) on 10 private/municipal properties in the Spofford Lake watershed. A second phase through the Section 319 Watershed Assistance Grant Program will fund implementation work at the boat ramp and parking lot and three shoreline properties to control stormwater runoff to the lake. Future phases will continue to educate watershed residents, implement stormwater improvements (both large-scale and small-scale), and improve water quality protections in municipal ordinances for smarter development in the watershed – all based on specific recommendations made in the WMP through 2026.

### Appendices

All deliverables for this project were provided to the NHDES as separate documents.

- Executed contract between consulting firm and SWRPC; project meeting minutes; semi-annual progress reports; pollutants controlled reports; and a final report submitted to DES.
- Draft and final SSPP approved by DES.
- Copies of the approved conceptual BMP designs and material cost estimates sent to DES and landowners.
- Copies of all necessary permits, cost-share agreements, and O&M plans submitted to the Town of Chesterfield, NHDES, and landowners.
- NPS Site Reports submitted to DES.
- Summary materials of outreach events submitted to NHDES.

**Spofford Lake Watershed Management Plan Implementation Phase I: Watershed/Shoreline BMPs**